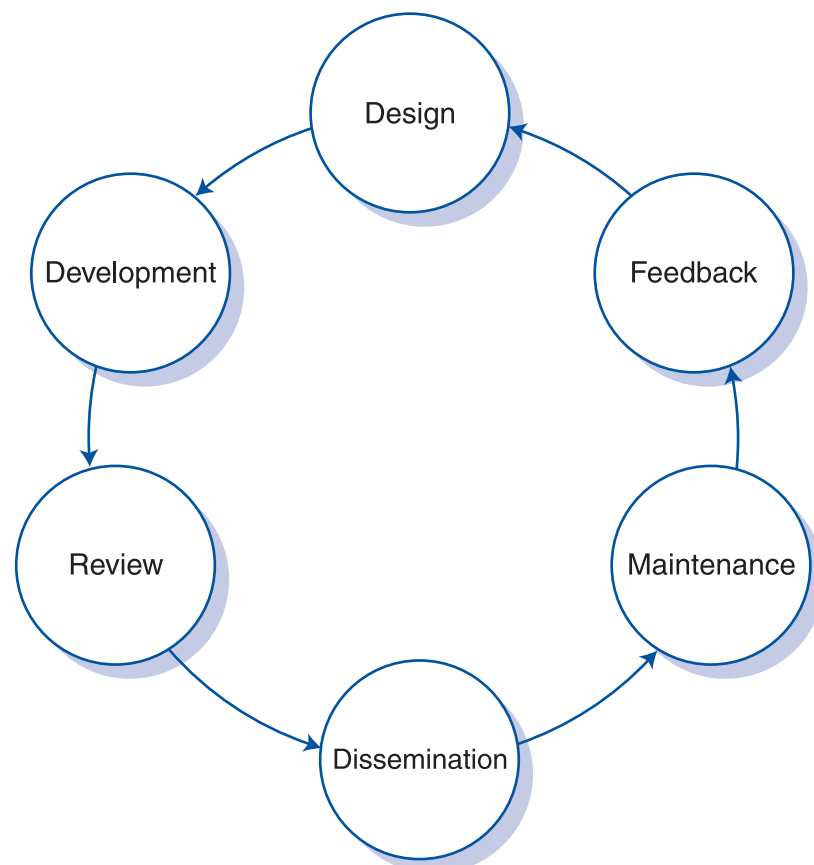


LESSONS LEARNED

about designing, developing, and disseminating

Environmental Information Products



*expanding access and
enhancing the usability of
environmental information*

Lessons Learned About Designing, Developing, and Disseminating Environmental Information Products

U.S. Environmental Protection Agency
Office of Environmental Information
Environmental Analysis Division

Abstract

*The Environmental Protection Agency (EPA) is committed to expanding access and enhancing the usability of environmental information under Goal 7 of the Agency's Strategic Plan. One way to expand access to environmental information is for the Agency to enhance existing data and to develop integrated information products derived from data compiled to support existing environmental management and regulatory programs. This is sometimes referred to as the **secondary** use of environmental data. The Office of Environmental Information (OEI) recently conducted a series of interviews with senior information managers to determine and articulate best practices for designing, developing, and disseminating information products, especially those based upon data collected for other purposes.*

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Lessons Learned About Designing, Developing, and Disseminating Environmental Information Products

EXECUTIVE SUMMARY

The Environmental Protection Agency is committed to expanding access and enhancing the usability of environmental information under Goal 7 of the Agency's Strategic Plan. One way to expand access to environmental information is for the Agency to enhance existing data and develop integrated information products based on data inventories that support environmental management and regulatory programs. It is important to evaluate information products as part of an overall effort to assure customer satisfaction and continuous improvement.

This Lessons Learned report focuses entirely on one environmental information gateway to the public: government information products. Environmental information products produced by EPA and states vary greatly in terms of management and implementation. As a result of their varying design and development protocols, the Office of Environmental Information sought to examine past efforts to develop information products in order to delineate lessons learned that may be helpful to future endeavors. Information contained in this report was derived primarily from interviews conducted with agency staff involved with the development and use of a variety of information products in order to understand and build upon their experience developing and managing information products. The ultimate goal of this project was to determine if there were some common lessons learned across various types of products and product developers.

An effort was made to incorporate a range of different product types. These include those driven by statute or regulation (e.g., the Air Trends and TRI reports); compliance-based products (e.g., Pennsylvania Compliance Reporting System and the Sector Facilities Indexing Project); those designed to enhance data management and compliance (e.g., Region 3's Enviroviz, and the Office of Water's Index of Watershed Indicators); and those involving numerous external stakeholders (e.g., the South Baltimore Pilot Project).¹

As noted above, we focused on identifying overarching issues rather than limiting the investigation to any one information product or category of products. However, our analysis did recognize that the lessons learned will vary according to specific product type and category. For example, compliance products can be controversial due to the response of specific facilities and

¹ Please see appendices for a complete list of the products evaluated, brief descriptions of each project, and a list of the individuals interviewed.

individuals to Agency programs. In this report, we have identified a set of issues and concerns that are generally applicable to the design and management of EPA and state information products. Where appropriate, we have referenced specific information products when discussing lessons learned.

Key lessons drawn from the interview process include the following:

- Almost all interviewees agree that it is critical to articulate a clear sense of the product's purpose early in the design process. As obvious as this may seem, interviewees stress that this step is frequently overlooked, resulting in redundancy among products, suboptimal user functionality, and other problems.
- It is a mistake to develop a generic information product. While the reality that information products circulate beyond their intended audience should be considered during planning, it should not be used as a rationale for avoiding the need to specify a target audience and its unique needs for environmental information.
- Stakeholder and product audience input must be sought at all points in the information product life-cycle. Early stakeholder involvement is especially important as it can help clarify goals, reduce skepticism, build consensus, and ensure the dissemination of information that meets audience needs.
- Data ownership is directly related to data quality concerns. While some users of secondary information products take the initiative and communicate effectively with originators of data, EPA lacks an organized framework to guide this kind of technical interaction. Many interviewees stress the importance of developing a mechanism to facilitate communication among producers and users of EPA data.
- To address concerns over data accuracy, some developers and managers interviewed note the importance of a "data feedback loop," through which facilities and other data providers are requested to verify data used in a particular information product. Beyond sending the data back to providers, some interviewees feel that the Agency should also consider initiating an internal comment period via an intranet-accessible form, allowing adequate time to make corrections prior to public release.
- It is necessary to consider all aspects of information usability. Misunderstanding and misapplication of information products can be avoided by providing users with comprehensive and carefully articulated metadata and contextual information.

As a result of these findings, the OEI, Office of Information Analysis and Access (OIAA) has embarked on developing a **Best Practices** series for information product development. Building on the feedback and recommendations from this report, OIAA will lead the Agency effort to develop and release guidance documents on each important phase of an information product's life-cycle. Each guide will consist of EPA examples of best practices, case study applications of these practices, and reference pertinent policy and guidance already in existence for each topic area. The overarching objective of the series is to disseminate helpful practices to EPA information product developers and managers. In doing so, OIAA and partners strive to heighten Agency information sharing and best practice implementation for environmental information products, thereby enhancing the credibility, usability and defensibility of EPA products.

What is an Information Product?

A joint EPA/State Action Team was recently convened to design and publish a periodic bulletin to inform stakeholders and the public of development and release of significant information products. The joint team defines a significant information product as: “A product under development or modification by EPA which derives from federal, state, local, tribal, or other organizations’ data, and a state product that is regional or national in scope and aggregates data from more than one state. Such products often generate considerable attention when they use [pre-existing] data to describe environmental conditions, trends, potential risks, and/or portray compliance or performance.”

Significant information products include the following:

- Products that analyze and/or compare data from various agencies and organizations, including industry, as well as various federal, state, tribal and local agencies;
- Significant raw unanalyzed data collected by EPA from various agencies and organizations;
- Products that describe or assess environmental conditions, trends, or risks;
- Products that apply to a large segment of the population or large geographic area;
- Models used by the public to perform environmental analyses based upon data from various agencies and organizations; and
- Annual reports and other products released on a regular basis that describe environmental conditions, trends, risks, and/or portray compliance or performance.

1. INTRODUCTION

1.1. Background

Information about the environment – environmental characteristics; physical, chemical, and biological processes; and chemical and other pollutants - underlies all environmental management decisions. Access to quality information and analytical tools is essential for public decision making, measuring environmental improvement, assessing and managing risks, and evaluating progress. Access to high-quality, user-focused information products will enable the public to understand environmental conditions and make informed decisions about their communities.

The Environmental Protection Agency articulates its commitment to expanding and enhancing access to environmental information in its Strategic Plan. Goal 7, *Expanding American's Right to Know About Their Environment*, stresses the importance of developing and disseminating information products that will enable the public, governmental agencies, non-governmental organizations and private sector parties to easily access relevant, usable, and quality-assured data and information products.

The vision of the EPA Office of Environmental Information (OEI) is to “advance the creation and use of data as a strategic resource to enhance public health and environmental protection, inform decision making, and improve the public’s access to information about environmental conditions and trends.” Key goals of the Office of Environmental Information include the following:

- Promote the public’s right to know,
- Improve information infrastructure,
- Reduce burden,
- Foster information partnerships,
- Improve data quality, and
- Foster data integration.

It is...critical to understand what makes information products effective, widely used, and technically credible.

The Agency’s approach to information product development and dissemination is relevant to all of OEI’s goals. It is therefore critical to understand what makes information products effective, widely used, and technically credible. It is especially important to assure the quality and user applicability of information products derived from existing data.

To this end, the Environmental Analysis Division (EAD) within the Office of Information Analysis and Access interviewed senior staff involved with the development of major environmental information products within and outside the Agency. The lessons learned from this activity serve as a resource for formulating information product guidance and will support a variety of efforts to foster continuous improvement in the development and dissemination of EPA information products. The themes and implications outlined in this document are part of an overall effort to characterize best practices and ensure continuous improvement in EPA information products, services, and policies.

1.2. Approach

As indicated above, the findings and recommendations articulated in this report were derived through a series of interviews with senior EPA and state staff involved in the development and/or administration of environmental information products. Working with an Advisory Committee of senior EPA staff and managers, OEI selected interviewees closely involved with projects resulting in a variety of information products, including paper-based reports, web-

based products and information applications, and multi-media products with geographical scopes of interest ranging from local to national perspectives. Many of these information applications utilize data collected for other purposes. All interviewees responded to the same questionnaire, and the research team focussed on common issues rather than investigation and critique of individual products. The products evaluated through the interview process can be grouped in terms of four broad categories:

Information Projects Reviewed

- ✓ Environmental Monitoring for Public Access and Community Tracking (EMPACT)
- ✓ Index of Watershed Indicators (IWI)
- ✓ National Air Quality and Emission Trends Report
- ✓ Pennsylvania Compliance Reporting System (PA CRS)
- ✓ Enviroviz
- ✓ Sector Facility Indexing Project (SFIP)
- ✓ South Baltimore Pilot Project
- ✓ Toxics Release Inventory (TRI)

- Information products that are driven by statutory or regulatory reporting requirements, such as the annual Toxics Release Inventory (TRI) and Air Quality Trends reports.
- Information products developed or used to facilitate regulatory compliance, such as the Pennsylvania Compliance Reporting System (PA CRS) and the Sector Facility Indexing Project (SFIP).

-
- Information products designed to enhance data management or facilitate the integration of diverse data sets, such as Enviroviz and the Index of Watershed Indicators (IWI).
 - Information products that involve extensive stakeholder input and/or review, such as the South Baltimore Pilot Project.

While diverse in many respects, the information products discussed during the interviews are similar because they are all based upon numeric, statistical, or graphical data. Most of these products are developed for secondary uses, a category that includes most information products from OEI. As illustrated in Exhibit 1, information products for secondary use are frequently based upon data extracted from EPA program systems. EPA data systems are used to support or administer regulatory programs, whereas secondary information products are designed to address other purposes. The information products reviewed during the interview process are all “data rich,” as opposed to those intended only to disseminate a message, broadcast the occurrence of an event, express an opinion, or describe an activity or program. Although all public communications are important and require thoughtful formulation, data-based information products present a special set of challenges. For instance, data-based information products require careful attention to factors such as accuracy, quality and precision, and the ability to support integration across multiple systems. These and other attributes of the primary data must be carefully considered in the design, development, and dissemination of information products intended to serve secondary purposes.

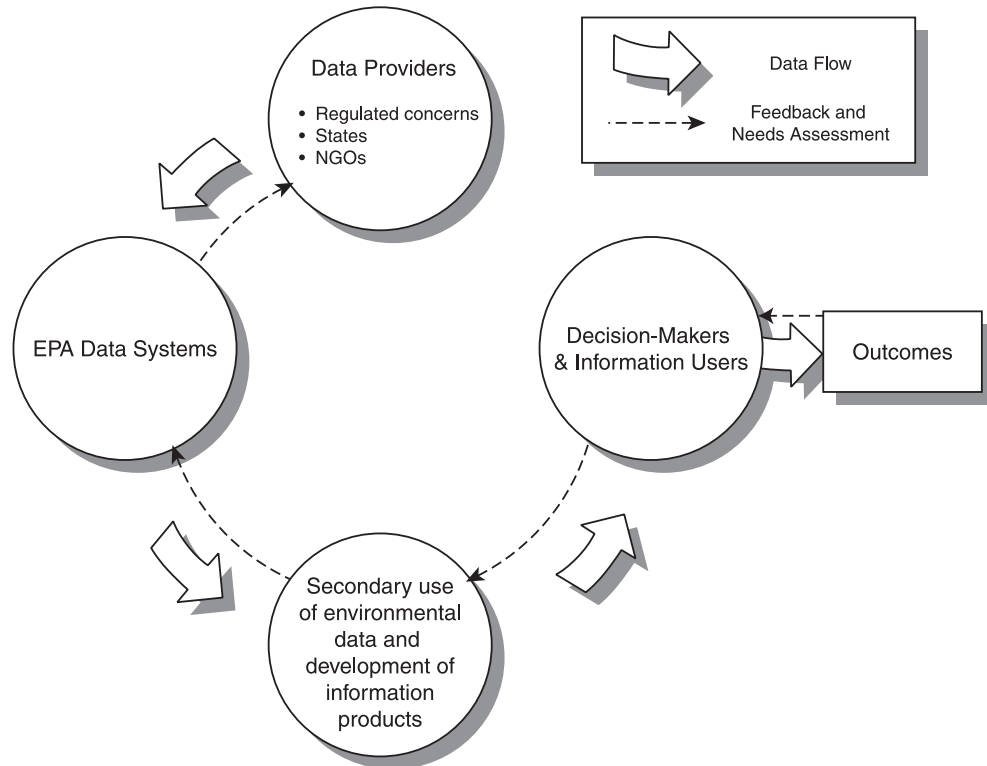
Although all public communications are important and require thoughtful formulation, data-based information products present a special set of challenges.

1.3. Organization of this Document

The remainder of this document is organized around two principal sections: (1) a summary of key findings organized in terms of major phases of the information product life-cycle: Design; Development and Review; and Dissemination, Maintenance, and Feedback; and (2) a concluding section that highlights implications for the Office of Environmental Information and recommendations for the success of EPA information products.

The document also includes three appendices: (A) Summary of Information Products Considered, (B) Advisory Committee Members, and (C) Interview Questions.

Exhibit 1. Secondary Use of Environmental Data: How Data Become Information Products



Most EPA data are initially collected or generated by first-order data providers, usually industry or other regulated entities and states. Data are then transferred from the original provider to EPA/state data systems, where they are used to support various regulatory and program administration activities. The data collected by EPA/state programs can also be used or adapted for use in secondary applications. Secondary applications include integration, consolidation, analysis, and context-specific uses of the original program data. The offices within the Agency, particularly the Office of Environmental Information (OEI), undertake various information development and enhancement initiatives, resulting in “secondary information products,” which are used by a wide range of decision-makers at the local, state and national level. Use of these information products lead to environmental and/or right to know outcomes. As suggested by the schematic (above), feedback from information users and decision-makers helps to improve information products. The process of moving from data to effective information products is inherently iterative and requires coordination with data providers and stakeholders.

2. KEY FINDINGS

As illustrated in Exhibit 2, the information product life-cycle can be characterized in terms of six aspects: design, development, review, dissemination, maintenance, and feedback. Findings from the interviews suggest important overlaps among these phases. For this reason, findings have been combined and presented in three basic groups: design; development and review; and dissemination, maintenance and feedback.

Exhibit 2. The Six Principle Aspects of the Information Product Life-Cycle

1. Design
2. Development
3. Review
4. Dissemination
5. Maintenance
6. Feedback

Placement of findings within the life-cycle framework will help to guide future product developers in a logical and progressive manner. As previewed below, the lessons derived through this study highlight the importance of a life-cycle approach to information product management.

- **Design.** The design stage of an information product includes defining the purpose and audience, aligning product scope and user needs, involving stakeholders, coordinating with other relevant efforts, defining data suitability criteria, addressing resource issues, and developing a product plan.
- **Development and Review.** The development phase requires input from customers, stakeholders, and data providers; consultation with data providers to assure suitability and accuracy; and configuration of products that are consistent with metadata.
- **Dissemination, Maintenance, and Feedback.** The dissemination stage goes beyond merely providing access to the product to ensuring timeliness, providing metadata, providing contextual information, and seeking and utilizing continuous feedback from users and stakeholders.

2.1. Design

The majority of interviewees strongly recommend adoption of a strategic approach in the information product design phase. Accordingly, information project managers should carefully consider the goal of the project, articulate intended audience and user needs, determine criteria to ascertain whether data collected for one purpose are suitable for other purposes, and identify possible

linkages with Agency partners with whom to collaborate on product development. Interviewees explain that early strategic planning allows project managers to better anticipate and respond to potential changes in a project's budget, goals, and target audience.

Identify Product's Purpose and Audience

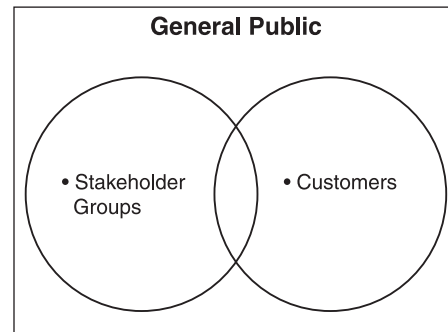
Almost all interviewees agree that it is critical to articulate a clear sense of the product's purpose early in the design process. As obvious as this may seem, interviewees stress that this step is frequently overlooked, resulting in redundancy among products, suboptimal user functionality, and other problems. As part of this process, it is important to identify primary audiences for the product, key stakeholders, and potential sponsors within and beyond the Agency (see Exhibit 3). Clear understanding of the purpose and the audience will help determine the methods used to compile and present the information for dissemination. Consequently, front-end goal articulation and audience identification are critical to the success and usability of an information product.

Align User Needs and Product Scope and Character

Most interviewees recognize the importance of delivering a product that meets the specific needs of an intended audience. Customer needs vary depending on the users' levels of proficiency in data use or analysis and their ultimate plans for the information. Interviewees caution that the actual

Exhibit 3. Stakeholders, Customers, and the Public

All of EPA's information products are developed and disseminated to serve the public's right to know about environmental conditions and trends. However, it is helpful to distinguish between "general public," "stakeholders," and "customers" for an information product. Customers are individuals or groups who will use the product. Information products should be developed to address the needs and capabilities of customers. Stakeholders are individuals or groups who will likely be affected by the use of the product. Stakeholders are frequently the original providers of data used in developing an information product. Although it is important to distinguish between stakeholders and customers, it is also important to recognize that stakeholders and customers sometimes overlap.



audience frequently extends beyond the intended audience. This requires managers to consider all potential users when defining the scope of a project. For instance, IWI was originally targeted at states as a tool to spark place-based discussion of water quality issues. Project managers recognized its potential value to the public, and expanded the scope of the project accordingly. While the reality that information products circulate beyond their intended audience should be considered during planning, it should not be used as a rationale for avoiding the need to specify a target audience and its unique needs for environmental information.

Interviewees emphasize that product developers should take care to distinguish between a user's need for raw data, interpreted results, or a summary report. They stress that product managers should adjust the degree of data interpretation according to the level of expertise of the expected audience. Interviewees also note that information products should avoid certain types of interpretation. Specifically, the Agency has often run into difficulty when attempting to rank facilities or areas based on available data. Interviewees stress that information products should not rank aspects of their information (e.g., facility compliance, relative stream quality, air quality variance, etc.). Instead, they should provide information that enables users to conduct such analyses on their own.

During the interviews, information product managers and designers reported on ways they address the issue of data interpretation when required by their products. Examples include:

- ✓ Informing stakeholders of the expected level of interpretation in the early phases of a project (PA CRS);
- ✓ Enabling users to adjust the algorithms that calculate ranking, risk, or similar assessments (IWI); and
- ✓ Targeting projects to local communities interested in specific sets of interpreted data (EMPACT).

Early Stakeholder Identification and Involvement

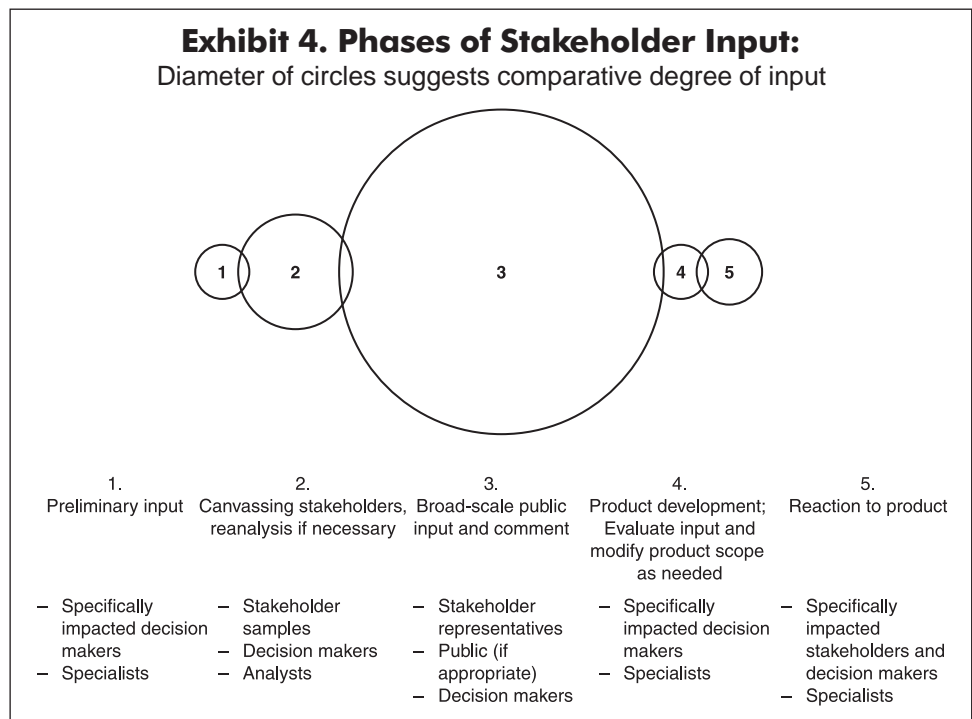
In addition to identifying and involving a product's audience, interviewees indicate that product teams should identify essential stakeholders and involve them early in the design phase. This distinction between users and data providers will vary and even overlap depending on the product, but interviewees felt it was essential for product developers to consider the needs of both the external user and the identified stakeholder group(s). This frequent overlap can be easily understood if adequate time is devoted to identifying the various parties (see Exhibit 3). Oftentimes, product developers consult only stakeholder groups, or "user groups", as a means of soliciting feedback. Some interviewees

suggest that such limited external input is not only inadequate, but that feedback is often misleading and perhaps even related to the perceived failure of an information product by the user community.

Early stakeholder involvement is especially important as it can help clarify goals, reduce skepticism, build consensus, and ensure the dissemination of information that meets audience needs. Exhibit 4 demonstrates how the scope and nature of stakeholder input can vary across the product life-cycle. Interviewees stress that while the initial cost of engaging stakeholders may exceed perceived benefits, in the end actual benefits will be higher than the initial cost. Resources may be utilized for product development and implementation rather than to justify and defend the information product to stakeholders.

The PA CRS provides a good example of the importance of involving stakeholders, especially when the product is perceived as controversial and faces criticism or resistance. PA CRS managers met frequently with industry representatives clearly indicating their intentions regarding the final product while being receptive to industry's concerns. Despite initial doubts, the affected industries participated in the design of the final product.

While interviewees advocate early involvement of stakeholders, they also believe there are limits to helpful stakeholder input. One respondent indicates that Agency experts need to spend more time determining what information they want to collect and why, before inviting stakeholders into the process. He believes that getting divergent opinions before having a clear



strategic plan results in confusion. The majority of interviewees agree that asking structured questions about a product results in the most manageable and useful form of feedback.

Determine Criteria to Ascertain Data Suitability

As discussed previously, many environmental information products tend to be data rich. It is therefore important to ensure that data utilized for these applications are suitable and appropriate for the anticipated use. The suitability of data may be determined by addressing the following questions:

What does the database cover? It is important to identify the kinds of information contained in the database (e.g. types of pollutants, facilities, permits, and acquisition methods).

Can the database be used for spatial analysis? Product developers should determine whether the data are available at appropriate geographical scales such as ZIP code, latitude and longitude, county code, state code, etc.

Can the database be used for temporal analysis? Product developers should determine whether the data are collected on a fixed schedule (daily, monthly, yearly, etc.) and if the data are sufficiently consistent over time to allow period-to-period comparisons.

How consistent are the variables over space and time? It is crucial to assess the degree of internal consistency, allowing comparisons across space (facilities, Regions, etc.) and over time (monthly, yearly, etc.)

Can data be linked with information from other databases? Product developers should determine the degree to which information can be linked with other databases based on common characteristics such as facility identification numbers, latitude and longitude, geographical codes, etc.

How accurate are the data? Product developers should seek and consult information from data quality checks performed by the Program Office as well as from statistical analysis performed by other organizations.

What are the limitations? Each of EPA's databases has a primary purpose for which it was developed and is maintained. As the databases are assessed for suitability for alternate uses, it is important to understand the constraints and limitations of the database.

How can I get information? It is crucial to identify formats in which the database is available such as printed form, diskettes, CD-ROM, online access, etc., along with names, addresses, and phone numbers to contact for detailed information.

Is there documentation? A quality database requires documentation to support it, such as information on data collection methods, quality assurance mechanisms, data management, users' guides, and information dissemination. Details on the availability of such documentation should be provided.

Coordinate with Other Relevant Efforts

Interviewees feel it is important to ensure that information product development is coordinated among similar efforts underway elsewhere at EPA, other federal agencies, or states. Adequate coordination will limit duplication of efforts, increase the utility of EPA data, and help ensure that Agency goals are being addressed. Several interviewees suggest that establishing Agency-wide procedures will result in a stronger relationship between information products and EPA's goals, providing managers with a meaningful context from which to measure product performance.

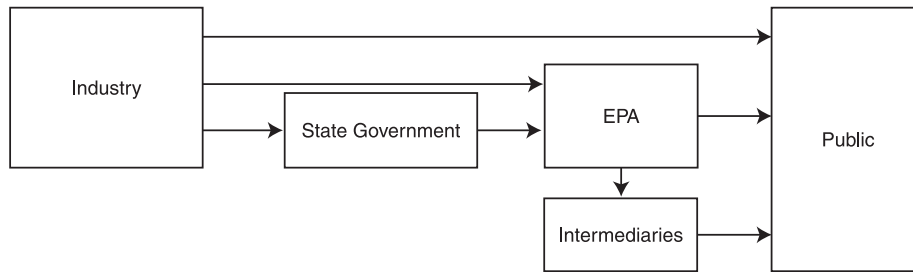
One interviewee emphasizes the importance of identifying external partners who are committed to the project and have the expertise to provide constructive assistance, especially in the early design phases of an information product. Effective partnerships between similar efforts can also help overcome budget constraints, promote data sharing, and increase data quality. Exhibit 5 portrays an illustrative partnership between EPA and a regulated industry.

EPA's Environmental Monitoring for Public Access and Community Tracking (EMPACT) Program, for example, provides funding to initiate community-level projects and encourages local partners to assume financial responsibility after EPA funds are exhausted. Data quality is enhanced through reviewing methods and sharing data by experts involved in similar efforts. Sharing information and coordinating efforts should go beyond the Agency to other federal agencies, as developers of IWI indicate.

Address Resource Issues

Resource considerations play a significant role in determining project success. This fact is especially true for information products with relatively less up-front Agency funding or support. Products mandated by legislation or regulation are often better funded than products that stem from user feedback, internal collaborations, or community-based partnerships. While a clearly defined budget should be developed in the early stages of the product life-cycle, it is necessary to maintain flexibility and revise the budget on encountering unexpected contingencies. Perhaps most importantly, interviewees stress that information product development requires a long-term commitment, suitable to support a product as it evolves through the design, development, stakeholder review, and dissemination and feedback phases.

Exhibit 5. Illustrative Information Partnership



In some cases, EPA obtains data from regulated industries, often through other government agencies (frequently at the state level). Under such a configuration, EPA and its state and/or industry partners can collaborate on efforts to improve public access and usability.

Budget planning should clarify both resource needs and availability. The definition of resource needs should extend beyond the early stages of product development and include all aspects of product design, development, and dissemination and feedback. While specifying resource availability, product planners should earmark initially available funds from the Agency as well as identify potential funding sources, internal and external to the Agency, to ensure successful completion of the project. As an example, developers of the South Baltimore Pilot Project note that they established their goals based on the size of the initial budget in order not to take on too much at one time. Even so, the project exceeded its budget and funds have not been made available to publish all findings.

Develop a Product Plan

Several product developers interviewed for this study emphasized the need for a product plan, which would formally contain strategic planning considerations relating to information product development and management. The product plan would contain three key elements:

- A summary of current circumstances, including explicit user-focused rationale for the product;
- A schedule and process description dealing with how the project team will approach each aspect of the product life-cycle (see Exhibit 2); and
- A clear statement of the outcomes expected to result from the product.

The plan should also address key tactical issues associated with the use of existing data, such as data appropriateness and accuracy, methodological issues, peer review procedures, data display and access issues, and general management of product content.

2.2. Development and Review

Traditionally, resources and activities tend to be concentrated on activities associated with the actual development of an information product. The focus is on methodological issues, testing, and review of the product. Interviewees express concern about this limited field of activity and articulate several issues requiring increased attention during the development phase of the product life-cycle.

Obtain Stakeholder Input During Product Development

As with product design, interviewees stress the importance of stakeholder input during product development. However, participants are divided on whether to seek open-ended or structured stakeholder input. Some interviewees indicate a preference for soliciting feedback on developed concepts rather than utilizing an entirely open-ended, unstructured approach. Representatives from TRI and the SFIP note the importance of thoroughly developing concepts and product drafts prior to soliciting stakeholder feedback, arguing that such an approach leads to more constructive feedback. Other interviewees contend that stakeholder input should be gathered to affect the product revision and redesign that tend to occur during development of product components. In one example, IWI managers worked with states and other stakeholders to complete a review of the overall program, the rankings, and the underlying methodology – a process that resulted in valuable contributions to the final product.

Recognize the Relationship between Data Acquisition, Use, and Quality

Data ownership is directly related to data quality concerns. While some users of secondary information products take the initiative and communicate effectively with originators of data, EPA lacks an organized framework to guide this kind of technical interaction. Many interviewees stress the importance of developing a mechanism to facilitate communication among producers and users of EPA data. This is especially important when data are being used for purposes other than those of their original collection. Respondents also express a desire for Agency-wide guidelines on conducting quality control protocols on data prior to using it for a secondary purpose.

An important question for interviewees is, “who should be responsible for ensuring data quality?” In many cases the concept of data quality is used casually by information product developers and designers as a way to refer to data accuracy and error correction procedures. This interpretation provides only a partial understanding of data quality, and does not sufficiently emphasize the fact that quality is a function of intended use. What one user considers data of high quality, another might deem wholly inadequate. A user’s perspective on data quality often extends beyond data accuracy into other data characteristics. For instance, is the data generalizable (for example, was it collected

using a probabilistic sampling model? Is this method for collection similar to other data sets?), is the data current (annual, monthly or periodic updates), or are there reproducible results (how thorough is the metadata and documentation information)? This is particularly relevant in cases where users must work with data they did not collect. In these situations, it can be presumed that users are not aware of the purpose behind the original data collection. Interviewees emphasize that information product developers must obtain and examine all available documentation, guidelines, and contextual information to assure that data are suitable for use in new, possibly unintended applications.

Improve Data Accuracy with Input from Data Providers

To address concerns over data accuracy, developers and managers of SFIP, IWI, and the South Baltimore Pilot Project note the importance of a “data feedback loop,” through which facilities and other data providers are requested to verify data used in a particular information product. In addition to assuring accuracy, such a procedure helps address concerns that information providers might have regarding the projects. Beyond sending the data back to providers, interviewees feel that the Agency should also consider initiating internal review procedures or a comment period via an intranet-accessible form, allowing data to mature internally prior to public release. For example, one respondent explained that his managers wanted an assessment of the quality of the data used in Enviroviz. Lacking established Agency standards, he developed a 3-level set of standards that he could then apply to data used in Enviroviz.

Continuously Involve and Utilize Feedback from the User and Information Provider

Feedback from product users and information providers is essential to develop useful products and improve data quality. Most interviewees stress the importance of eliciting feedback about data quality, usability, and clarity from product users and information providers. As illustrated in Exhibit 6, interviewees recognize that the need for input from users and data providers will vary depending on product type and affected parties.

2.3. Dissemination, Maintenance, and Feedback

The ultimate success of an information product is reflected by the reaction of its audience. Interviewees emphasized issues relating to user satisfaction such as timely release, data quality, metadata, contextual information, and continued solicitation of feedback.

Remain Committed to Information Availability in a Timely Manner

Interviewees stress the importance of making environmental information available in a timely manner. When the research team began this project, a

Exhibit 6. Affected Parties by Product Types

Affected Parties	Role	Sample Product Types
Regulated community	Users	Models to estimate emissions, calculate compliance costs, and identify substitute inputs
Regulated community, state and local governments	Data providers	Software for inputting data or transferring data to EPA
Regulated community, state and local governments, interested members of the general public	Data providers and users	Status and trends tool

primary concern was the degree to which Agency data managers might be hesitant to release information for fear of its inappropriate use. For example, some non-government organizations may use data from TRI or the Air Trends Report and include it in area rankings in a manner that EPA would not support.

The research team raised this issue with each interviewee. In almost all cases, they indicate that they recognize the problem, but view it as beyond the Agency's control. Some respondents suggest that managers should make an effort to anticipate secondary uses and do their best to consider them as they complete product development, while recognizing the impossibility of foreseeing all possible uses for Agency data. Above all, interviewees said that the Agency cannot let this concern interfere with the timely dissemination of information.

Rather, the Agency should work to ensure that products are derived from suitable data and are packaged with sufficient metadata and other descriptors of appropriate use to minimize the misuse of the primary data. All data-based information products should include relevant metadata (i.e., data about the data) and clearly identify the intended use of the product to minimize, if not eliminate, possible misuse of data. Agreed-upon data quality and suitability goals can be integrated into a product's design and facilitate timely release.

Approach Dissemination as an Opportunity to Improve Data Quality

Some interviewees argue that data quality will improve through widespread dissemination and use. This group argues that users will offer feedback, and in turn, Agency commitments to the public's right to know will not be compromised with lengthy internal reviews. The impetus for this view is based on the following logic: improved access and display will lead to

increased use, increased use leads to increased scrutiny, increased scrutiny will identify discrepancies, and the Agency will respond by correcting errors and/or clarifying misperceptions.

Provide Customers with Easy-to-Understand Metadata

The term “metadata” refers to information about a data-based product’s content, technical configuration, and the methods used for analysis and/or data collection. Metadata is needed so that users can assess data quality and appropriate use in relation to their own needs. The development and placement of adequate metadata within information products is a particularly important issue for EPA because secondary users constitute a significant audience for the Agency’s information products. While EPA is making widespread public access to environmental information a reality, it is critical that all information products provide sufficient documentation for their intended audience.

Furthermore, by defining data suitability objectives and making them available as part of the metadata, product designers can avoid potential misunderstandings and clarify the known quality of the data. For example, SFIP managers received several complaints about displaying out-of-date data; however, since SFIP is only updated once every quarter to half-year, users should expect some time lags. Therefore, it is important to indicate how often the data are refreshed or updated using simple, non-technical language.

Provide Sufficient Context when Releasing Data

Beyond the provision of metadata, several interviewees suggest that, where appropriate, products need to include an overarching statement of context as another way to orient users and avoid potential misinterpretation. For example, several interviewees express concern that releasing monitoring data may lead to the wrong impression that states with more comprehensive monitoring or enforcement programs have more serious environmental problems than other states that collect and/or maintain comparatively less data. Interviewees suggest that a solution might be to include information describing the extent and nature of a state’s monitoring network(s). This concern extends beyond a previous finding which calls for adequate metadata with information products.

A similar problem arises whenever new or enhanced monitoring is implemented or displayed. As one interviewee explains, methodological changes for estimating emission trends in the Air Trends Report resulted in data and graphs that did not look the same as they had in the past. This caused some readers to mistakenly infer changes in environmental outcomes. He suggested that increased attention to contextual information would help to avoid such misinterpretation.

Improved access and display will lead to increased use, increased use leads to increased scrutiny, increased scrutiny will identify discrepancies, and the Agency will respond by correcting errors and/or clarifying misperceptions.

Seek and Facilitate Feedback and Continued Communication with Data Users and Providers

Communication should extend past the design and developmental phases of an information product, and continue after the product's release. Maintaining communication with data providers will enable product designers to solicit and receive corrections and updates. Several interviewees note that the realization that information will be analyzed and distributed is a motivating force behind efforts to improve data quality. For example, IWI currently includes a designation noting cases when insufficient data exist to draw a conclusion about water quality. When states or other users see the designation applied to their information, they often seek to increase reporting and provide additional data, therefore improving data quality.

3. IMPLICATIONS FOR OEI

The EPA Office of Environmental Information acts as the steward of the Agency's environmental information, ensuring that EPA and other concerned organizations collect, develop, and disseminate high-quality and useful information about environmental conditions. Although focused on serving the public's right to know about environmental issues, OEI aims to move beyond the provision of existing data and generate new information products that are responsive to identified user needs. Increasingly, environmental information products are derived from data originally collected to support state or federal regulatory programs or management activities. Assuring the suitability of these data for new applications is therefore of paramount importance.

After completing the interviews with information product designers and managers, the research team focused on identifying a set of overarching lessons learned and their implications for the Office of Environmental Information. Summarized below, these lessons will serve as the basis for a series of "Best Practices" reports. The best practices will help EPA product developers and managers assure that information products are useful, credible, and fully applicable to user needs and access preferences. Organized around the themes outlined below, the best practices series will compile existing knowledge and documentation, and when necessary, introduce new methods and approaches to assure that EPA information products are always "on the mark" with respect to user needs and environmental decision making.

Avoid Defining Your Audience as "The Public"

EPA is currently striving to expand and enhance its role as a communicator of environmental information. OEI should develop guidelines to help analysts integrate product performance goals with the needs of specific target audiences. Such guidelines would help the Agency anticipate how the utility of a particular product might vary from group-to-group. Depending on the audience, developers can incorporate various types of software formats, technical language, embedded caveats, collection context, and helpful hints. Beyond the presentation of information, the rate of error correction or product updates could also depend on the intended use and corresponding audience. Issues such as these are easy to overlook when the external audience is classified as "the general public."

Data Quality is a Function of Data Use

Data quality is not a generic concept. It is critical that data quality be considered in light of its intended use. The quality of data is a function of its characteristics and limitations in the context of a particular application. OEI should develop guidelines and resources to help product planners and Agency analysts judge the suitability of data for particular user applications. Without best practices concerning the suitability of existing data for anticipated applications, the credibility of EPA information products may suffer.

Assure Credibility with Methods Review and Documentation

A standardized approach to assure that information products are planned and developed using appropriate analytical tools, documentation, and review procedures will help to increase the credibility and usability of information products. Although all EPA products, prior to dissemination, are subject to review by the originating office's designated communications officer, OEI should develop Agency-wide guidelines for methods review and documentation of the development of an information product. The latter is especially important as it assures replicability of results.

Develop Guidelines for Stakeholder Involvement

Depending on the nature of the information product and its intended use, the appropriate type, scope, and timing of stakeholder participation can vary significantly. Input can range from comments on both the products themselves and/or the raw data contained within a product. OEI could help develop guidelines for stakeholder involvement, focussing on how input might vary with level of product maturity, phase of the product life-cycle, and other key factors.

Information Customers Need Metadata

OEI has a lead responsibility in developing Agency-wide guidelines for metadata to be included with information products. Increased attention to preparing metadata should be a key component of the Agency's public access efforts as it is critical to ensuring the development of useful and credible information products and assists secondary uses of Agency information.

Facilitate Life-Cycle Information Product Planning

The factors discussed above must be approached in an integrated manner. As a final step, OEI should develop comprehensive information product planning procedures to assist program offices in evaluating the long-term goals for designing and maintaining information products. The guidelines should help managers consider target audiences, appropriate stakeholder involvement, quality assurance procedures, budget requirements, and other key product development and maintenance factors. Resources developed by OEI should be formulated and couched to help planners address the full life-cycle of an information product (see Exhibit 2).

The Upshot: A Need for "Best Practices"

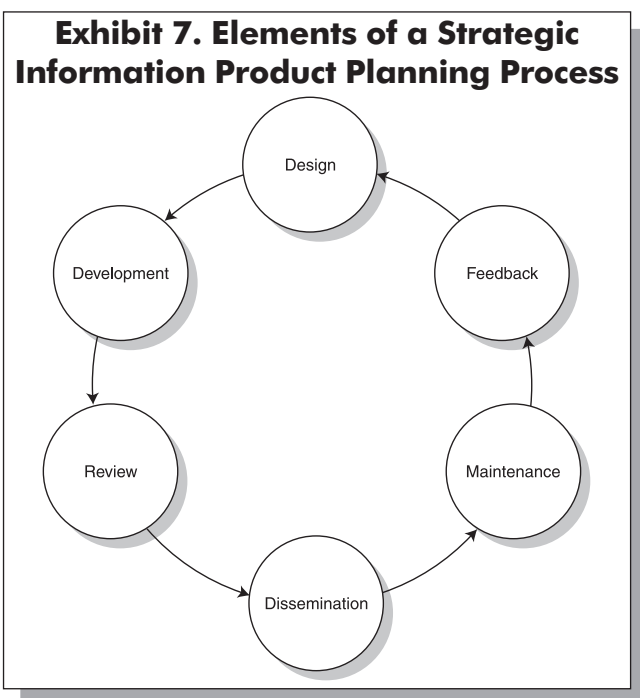
The Environmental Protection Agency strives to gather, utilize, and provide reliable and timely data to make decisions, improve information management, document and measure performance, reduce reporting burdens, and enhance public access. OEI's OIAA sought to reexamine past information product efforts in order to delineate lessons learned that may be helpful to future endeavors of information product design, development, and dissemination as they feed into these overarching themes. The interview process did not result in any

“magic bullets” to assure perfect information products. Interviewees did, however, recommend a variety of practices that tend to contribute to the effective design, development, and dissemination of information products. The individuals interviewed for this project share decades of experience working with environmental information products. They shared both successes and failures, what to do as well as what to avoid. Overall, the findings demonstrate that EPA has a wealth of information product experience that is not being adequately communicated to information product developers who could learn from it. However, beyond information sharing and technology transfer, a perceived gap exists for guidance on sound analytical approaches to the reoccurring data concerns, specifically for information product applications.

As a result, OEI will now embark on the Best Practices Series, a series of Agency guides on information product development. The purpose of this series is to help information product developers create products of known quality and usability for an external audience. In doing so, OEI and partners will strive to heighten Agency information-sharing and technology transfer and reduce internal burden, thereby enhancing the credibility, usability and availability of EPA products and ultimately providing more information of higher quality to the user. Analysis of the information captured through this interview process suggests that best practices tend to reinforce one another. Not only is it important to articulate and heed best practices, it is important to do so in an integrated manner. Depicted in Exhibit 7, below, adoption of an integrated approach to information product management would help to ensure continuous improvement, enhance the public’s right to know, and support the mission of the Office of Environmental Information.

Not only is it important to articulate and heed best practices, it is important to do so in an integrated manner.

The best practices series will also help EPA and state program managers as they oversee regulatory and administrative data systems, helping them to anticipate new uses for their data. In a similar vein, the best practices will be useful to grantees and other external stakeholders who collect environmental data, assuring the ever increasing suitability of data for unforeseen applications and the overall usability of EPA information.



APPENDIX A – Information Products Discussed

Project and Category	Contact(s)	Information Product Description
Environmental Monitoring for Public Access and Community Tracking (EMPACT) <i>statute or regulation (Executive Order)</i>	Denice Shaw Charlotte Cottrill	EMPACT sponsors and assists with local projects that collect real-time and time-relevant information about ambient environmental conditions such as water quality and ozone levels. At present, there are EMPACT projects in 86 metropolitan areas. See also http://www.epa.gov/empact/ .
Index of Watershed Indicators (IWI) data management and <i>information dissemination</i>	Charles Spooner	IWI is a web-based product that displays water quality data on regional and national levels. The data displayed on the maps reflect the current conditions and vulnerability of water resources. IWI is targeted at both states and the public. The data come from a variety of sources including OW partnerships with USGS and NOAA. See also http://www.epa.gov/iwi/ .
National Air Quality and Emission Trends Report <i>statute or regulation</i>	David Mintz Tom Curran	The Air Quality Trends Report assesses national and regional trends in air quality and monitored emissions. OAR uses the report to gauge air quality, pollution reduction, and pollutant levels as a part of the Clean Air Act (CAA). Sections include discussion on air quality trends for criteria pollutants, air quality on local levels, the status of areas that do not meet NAAQS standards, air toxics, visibility trends, and acid deposition. The report is available in hard copy or as a PDF file from the OAR web site. See also http://www.epa.gov/oar/oarpubs.html .
Pennsylvania Compliance Reporting System (PA CRS) <i>compliance focus</i>	Kim Nelson	Pennsylvania designed PA CRS to collect and display compliance information for Department of Environmental Protection (DEP) employees. As part of a shift in DEP policy away from enforcement and towards compliance assistance, PA CRS measures and reports on ongoing compliance efforts. While the reporting system itself is for internal use only, results are reported on the web for the public. See also http://falcon.state.pa.us/crs/web/crs_interface.frames_start .

Project and Category	Contact(s)	Information Product Description
Region III Enviroviz <i>data management and information dissemination</i>	Alvin Morris Rich Paiste	Enviroviz displays compliance, environmental quality, budget, and GPRA information on maps and graphs using two and three-dimensional graphics. Users can “brush” certain features to retrieve metadata about the monitoring station, data collection method, numerical data, specific pollutants, and other details. Users can view information by region, state, congressional district, county, or watershed. Enviroviz is not yet available beyond the pilot project.
Sector Facility Indexing Project (SFIP) <i>compliance focus</i>	Mike Barrette	SFIP is a web-based pilot project that integrates environmental compliance data from five different industrial sectors including automobile assembly, iron and steel production, pulp manufacturing, petroleum refining and nonferrous metals smelting and refining. It reports on approximately 650 facilities. Its primary purpose is to centralize and increase accessibility to facility information from a range of EPA databases. See also http://es.epa.gov/oeca/sfi/ .
South Baltimore Pilot Project <i>stakeholder involvement</i>	Henry Topper	This project represents a community-based approach to environmental protection and economic development. When complete, it will provide South Baltimore communities with risk-based environmental information on a variety of areas including cancer, parks, abandoned housing and trash, economic development, and air and water quality. Volunteer teams of citizens and environmental, industry, and government representatives coordinate different project components. See also http://www.epa.gov/opptintr/cbep/baltodex.htm .
Toxics Release Inventory (TRI) <i>statute or regulation</i>	Steven Newburg-Rinn Odelia Funke John Melone	Mandated by the Emergency Planning and Community Right to Know Act (EPCRA) of 1986, TRI displays information about chemicals designated as potentially hazardous. Facilities that meet TRI requirements must report on their estimated chemical releases, transfers, waste treatment, pollution prevention, and recycling activities. TRI data are available in web and CD-ROM format as well as in various information packets and reports. See also http://www.epa.gov/tri/ .

APPENDIX B – Advisory Committee Members

Name	Date Interviewed
George Bonina <i>Office of Environmental Information (OEI)</i>	August 30, 1999
Tom Curran <i>Office of Air and Radiation (OAR)</i>	August 12, 1999
David Davis <i>Office of Water (OW)</i>	August 18, 1999
Steve Goranson <i>Region V</i>	September 28, 1999
Barnes Johnson <i>Office of Solid Waste and Emergency Response (OSWER)</i>	August 24, 1999
Alvin Morris <i>Region III</i>	September 3, 1999
Charles Spooner <i>Office of Water (OW)</i>	September 8, 1999
Frederick Stiehl <i>Office of Enforcement and Compliance Assurance (OECA)</i>	August 26, 1999
Henry Topper <i>Office of Prevention, Pesticides, and Toxic Substances (OPPTS)</i>	September 13, 1999

APPENDIX C – Interview Questions

Product Identification

- What was the original impetus for developing your project?
- What information need is the product designed to address?
- Who is your primary audience? What methods, if any, did you use to target your audience or get feedback during the development process?
and
- Have you included stakeholder input in the development of your product?

Product Development

- How much raw data are included in the project? How much interpretation? What kind of metadata do you make available to product users?
- Are you concerned about the respectful use or misrepresentation of the information included in your product? If so, what do you do to address these concerns?
- Do you solicit customer feedback? If so, how? Do you target a specific subset of your users, or do you attempt to reach all users?
- Do you make any effort to coordinate your product with others offered by EPA through linkages, shared data, or another mechanism? Have you tried to integrate your product with other databases or products?
- Do you have a process for identifying or soliciting alternative reporting methods for data? Do you accept data from external sources? and
- Are there Agency guidelines that dictate how you collect or present data? Do you submit your data or product to peer review?

Product Management and Future Commitment

- What resources do you currently have available for the production of your information product?
- Do you have a product evaluation program in place? If so, who are the evaluators? Has your product changed over time because of such input? Do you think an evaluation process adds credibility to a product?

-
- What kind of political commitment is there to sustaining your product in your office/in the Agency? Do you think that the current level of commitment will be sufficient to support the continued growth and development of your product?
 - Do you expect any dramatic changes in your future mode of operation or in the maintenance of your product; and
 - What would you do differently if you could redesign this product?